IMPERIAL MYCOLOGICAL INSTITUTE
20 SEPT. 1933

Eleventh Annual Report of the Rubber Research Scheme (Ceylon).

(Second Annual Report of the Scheme established under Ordinance No. 10 of 1930.)

PROCEEDINGS DURING THE YEAR

1932.

RUBBER RESEARCH SCHEME · CEYLON ·

March, 1933.

H. W. CAVE & CO., PRINTERS.

ELEVENTH ANNUAL REPORT OF THE RUBBER RESEARCH SCHEME (CEYLON).

(Second Annual Report of the Scheme established under Ordinance No. 10 of 1930).

CHAIRMAN'S REPORT

The Rubber Research Scheme (Ceylon) was established by Ordinance No. 10 of 1930 which came into force on August 1 of that year. Work under the old Research Scheme was continued up to the end of 1930, so 1932 may be regarded as the second year under the present constitution of the Scheme.

Board Membership.—The following changes in the membership of the Board occurred during the year:—

Mr. J. A. D. Finch Noyes resigned on March 6 and was succeeded by Mr. G. K. Stewart, M.S.C.

Mr. J. Farley Elford resigned on July 9 and was succeeded by Mr. B. M. Selwyn.

Mr. J. D. Hoare resigned on October 15 and was succeeded by Mr. E. W. Whitelaw.

Mr. F. H. Griffith proceeded on leave in November and Colonel G. B. Stevens was nominated to act during his absence.

The composition of the Board at the end of 1932 was as follows:—

Chairman, Director of Agriculture, Dr. W. Youngman.

Treasury representative, Acting Financial Secretary, Mr. C. W. Bickmore, C.C.S.

Unofficial Members of the State Council nominated by the Governor.

Mr. E. C. Villiers, M.S.C.

Mr. H. R. Freeman, M.S.C.

Mr. J. L. Kotalawala, M.S.C.

Members nominated by the Ceylon Estates Proprietary Association.

Colonel T. Y. Wright,

Mr. G. K. Stewart, M.S.C.

Members nominated by the Planters' Association of Ceylon.

Mr. B. M. Selwyn,

Colonel G. B. Stevens,

Members nominated by the Rubber Growers' Association.

Mr. I. L. Cameron,

Mr. E. W. Whitelaw.

Members nominated by the Low-country Products Association.

Mr. F. A. Obeyesekere, M.S.C.,

Mr. C. E. A. Dias, J.P.,

Mr. James P. Fernando,

Mr. A. E. de Silva.

Members nominated by the Governor to represent Small-Holders.

Mr. C. A. Pereira,

Mr. B. F. de Silva.

Meetings.—The Board held meetings on January 28, April 28, June 30, July 1, September 22 and November 17.

An Estate Committee, appointed by the Board, held meetings on May 5, May 28 and June 6.

London Committee.—It was announced in the annual report for 1931 that the Rubber Research Institute of Malaya had agreed to a scheme for the continuation of research work in London on the basis of equal contributions by that Institute and the Rubber Research Scheme (Ceylon). The Malayan contribution was agreed to for a period of 3 years but Ceylon, in the first place, only agreed to contribute for one year pending further consideration. The Board of the Rubber Research Scheme (Ceylon) has since decided to contribute for the 3 year period accepted by the Malayan Institute. This scheme came into operation at the beginning of 1932.

The London Advisory Committees of the Rubber Research Scheme (Ceylon) and the Rubber Research Institute of Malaya held a joint meeting in January and decided that these Committees should be dissolved and succeeded by a new Committee known as the London Advisory Committee for Rubber Research (Ceylon and Malaya) to take charge of the joint scheme of research. The arrangements were approved by the Boards in Ceylon and Malaya and the Committee was duly formed, meetings being held on May 27 and October 28.

A Technical Sub-Committee consisting of members of the Advisory Committee and certain co-opted members, was formed and held meetings on June 24 and October 28. Details of the constitution and personnel of the Committees are given in the report of the London Committee.

STAFF.

Director of Research.—Mr. T. E. H. O'Brien was appointed Director of Research at a meeting of the Board held on January 28, and assumed duties in that capacity in addition to continuation of his chemical work.

Mycologist.—Mr. R. K. S. Murray proceeded on home leave in April, 1932 and was absent for the remainder of the year. Arrangements were made for the re-engagement of Mr. Murray for a further period of service. He will take charge of botanical as well as mycological work on his return from leave.

Agricultural Assistant.—Mr. W. I. Pieris continued his duties in this capacity.

Secretary.—Mr. J. I. Gnanamuttu vacated the post of joint Secretary to the Rubber and Coconut Research Schemes and reverted to Government Service from October 1. Mr. O'Brien took over the secretarial work of the Scheme and the office was moved from Peradeniya to Culloden, as from that date.

It was not considered advisable to increase the technical staff in view of the unsettled condition of the Industry and uncertainty regarding the future level of income of the Scheme.

Provident Fund.—The employees' Provident Fund scheme, referred to in the report for 1931, came into operation from the beginning of 1932 so far as concerned the subordinate staff of the Scheme and from the commencement of new agreements in the case of senior officers. Certain amendments to the draft rules were proposed during the year and await confirmation.

A statement of accounts for the year was supplied to each contributor to the Fund, as required by the rules.

Development of the Research Scheme.—This subject received the careful attention of the Board throughout the year. After consideration of a memorandum prepared by the Director of Research, outlining his views on development, an Estate Committee of the Board was deputed to examine the financial position of the Scheme and report on the proposals of the Director and the extent to which they could be put into effect under present financial conditions. The Board discussed the recommendations of the Committee and decided in favour of acquiring 100 acres of Crown land at Liniyawa and the purchase of a mature estate in the vicinity, provided that a grant from the balance of the Restriction Fund could be obtained for the purpose. Correspondence with the Hon'ble the Minister for Agriculture and Lands led to doubt regarding the acceptability of the proposals

and the position was also modified by the offer of a block of Crown Land adjacent to the present Experiment Station, Nivitigalakele. At the last meeting of the Board held during the year the Director of Research was instructed to make enquiries concerning alternative estates in the district which might be suitable and available for experimental purposes.

Progress in the development of the Scheme has admittedly been slow but the Board is fortunate in not having been involved in extensive commitments before the curtailment of rubber exports led to a diminution in the income of the Scheme and in being free from the financial embarrassment which would have resulted.

Grant to the Rubber Growers' Association.—The Board recommended to Government the allocation of a sum of Rs. 50,000 from the Rubber Restriction Fund as a grant to the Rubber Growers' Association for research in relation to new uses for rubber. A grant of Rs. 25,000 for the purpose was approved by the Executive Committee of Agriculture and Lands and has been sanctioned by His Excellency the Governor.

Finance.—The income of the Scheme for the year amounted to Rs. 149,266·39 this being mainly derived from a cess of $\frac{1}{8}$th cent per lb. of raw rubber exported from the Island. The monthly collections were as follows :—

January	... ...	Rs. 18,907·37
February	... ...	,, 12,604·56
March	... ...	,, 9,866·67
April	... ...	,, 8,739·37
May	... ...	,, 10,836·23
June	... ...	,, 9,552·37
July	... ...	,, 9,775·42
August	... ...	,, 13,276·85
September	... ...	,, 14,651·95
October	... ...	,, 8,241·59
November	... ...	,, 11,671·89
December	... ...	,, 12,622·77
	Total	Rs. 140,747·04

Expenditure for the year amounted to Rs. 82,232·46, including depreciation of items on capital account. The balance sheet at December 31, 1932, shows cash on fixed deposit and current account and cash in hand amounting to Rs. 219,904·10. From this balance the sum of Rs. 1,500·17

is earmarked for sundry creditors and Rs. 1,827·05 on account of Employees' Provident Fund leaving an available balance of Rs. 216,576·88 to be carried forward.

A sum of Rs. 6,314·31 was spent on the upkeep of the Experiment Station, Nivitigalakele, the development account of which now stands at Rs. 90,984·47.

The accounts of the Scheme have been audited by the Auditor-General and his certificate and report, together with the income and expenditure account and the balance sheet, are annexed.

The reports of the Director of Research, Mycologist, and Agricultural Assistant and the report of the London Advisory Committee for Rubber Research (Ceylon and Malaya) are appended to this report.

(Sgd.) W. YOUNGMAN,
Director of Agriculture,
Chairman of the Board,
Rubber Research Scheme (Ceylon).

25th February, 1933.

REPORT OF THE DIRECTOR OF RESEARCH FOR 1932.

The writer was appointed Director of Research in January and assumed duties in that capacity in addition to retaining the post of Chemist.

Head office of the Scheme was transferred to the laboratories on October 1 and charge of secretarial and accounting work was taken over from that date.

Mr. R. K. S. Murray was away on home leave from April to the end of the year.

Mr. W. I. Pieris, Agricultural Assistant, continued in charge of the Experiment Station, Nivitigalakele and undertook certain field and laboratory investigations.

In view of the depletion of technical staff which is indicated in the above paragraph it is not surprising to record that no very substantial advance in research work has been possible during the year. Progress has, however, been made in various directions and is considered under the appropriate headings below. The depletion of staff must be regarded as a reflection of the prevailing economic depression. In view of the uncertainty of the future level of the Scheme's income it was unavoidable that consideration of the appointment of additional staff should be postponed for the present.

DEVELOPMENT OF THE RESEARCH SCHEME.

The policy of development which the Board has adopted is to make progress both in the direction of agricultural research dealing with tapping, manuring, soil erosion, replanting, testing of clones etc. and chemical research relating to latex and improvement of the properties of raw rubber to increase its utility for various purposes. The latter work will be carried out in collaboration with the staff of the London Advisory Committee for Rubber Research (Ceylon and Malaya) to whose expenditure the Board has decided to contribute for a period of 3 years. Recognition of the value of direct research on "new uses", which to a large extent can be conducted more satisfactorily in a manufacturing centre than in the east, is shown by the recommendation of a grant to the New Uses Committee of the Rubber Growers' Association.

A good deal of preparatory work was done during the year in furtherance of the Board's policy. In connection with the proposal to acquire a mature Rubber area for experimental work visits were made to ten estates for the purpose of reporting on their suitability. Several areas of Crown

land were also inspected and reported on. Mr. Murray, while on home leave, spent 3 weeks at Rothamsted Experimental Station studying the latest developments in methods of field experimentation. The experience will be of great value in designing the field experiments which will be laid out when land is available and of which Mr. Murray will have charge. In order to gauge the difficulties of laying out experimental plots in a mature Rubber area where the stand of trees is irregular, a small area near to the laboratories was divided up into 3 plots on the lines which would be required for manuring trials. Records of yield kept for a period of 6 months, showed a variation between the plots in the ratio 100 :92 :79. This indicates the importance of carrying out uniformity trials before field experiments are undertaken.

It was decided to try to interest small cultivators in the potentialities of high yielding planting material by the issue of plants budded with various proved clones, at a nominal price. A nursery of 15,000 plants, which will be thinned out by about 50 per cent., was laid down at the Experiment Station and it is hoped that some of them will be ready for budding this year.

CHEMICAL SUBJECTS.

Crumb Rubber.—The staff of the London Advisory Committee has developed a process for the preparation of raw rubber in crumb form and various patents covering the methods have been taken out by the Rubber Growers' Association on behalf of the industry. Put briefly there are 2 distinct processes, the earlier of which depends on the production by chemical means of a coagulum which can readily be broken up into crumb. A later development is to use ordinary crepe rubber as raw material and break it down into crumb by chemical means. This product is being prepared at the London laboratories on a sufficiently large scale to supply samples to manufacturers for works trials. A machine has been obtained for trial of the process in Ceylon and is being installed at an estate near to the laboratories.

Trials of the earlier method of preparing crumb rubber were carried out in Ceylon and a number of samples forwarded to the London staff for examination. The material appears to be unsuitable for general purposes owing to its poor tensile properties but it has other interesting properties which may render it suitable for special purposes for which rubber is not at present used. A request for a 2 cwt. sample of this type of crumb has recently been received. It should be emphasized that both

the preparation and utilisation of crumb rubber are only at an experimental stage and it is impossible to foretell whether any commercial development will result.

Hot Water Treatment of Coagulum.—In collaboration with the London staff an investigation has been continued of the influence of hot water treatment of coagulum on the plasticity of crepe rubber. Several series of samples were forwarded for examination and the conclusion was reached that "the advantages of hot water treatment of crepe (in improving plasticity) are definite though not particularly marked. The method of preparation should however avoid the difficulties which manufacturers state they experience owing to occasional consignments of hard rubber". The method consists of soaking the partially rolled coagulum in boiling water for ten minutes and could be carried out on estates without great expense. Apart from improvement in plasticity the treatment may prove attractive to producers on account of its influence on the appearance of the rubber. The hot water appears to have the effect of destroying the oxidising enzymes which are present in the latex and consequently the crepe retains its pale colour during storage, even in absence of sodium bisulphite. Crepe treated with hot water also appears to have less tendency to develop mould during drying. Suitable tanks have been obtained for testing the process on a moderately large scale and trials will be carried out during 1933. The London Advisory Committee has asked for ½ ton of the material to be supplied for distribution to Manufacturers who have undertaken to test its suitability for various purposes. A recommendation on the adoption of the treatment on a commercial scale is deferred until manufacturers' reports are available.

Crepe Drying.—During the greater part of the year the selling price of crepe rubber was about 2 cents higher than that of smoked sheet and this led to an increase in the proportion of crepe rubber produced on estates. In many cases estates equipped with creping machinery handled the crop from neighbouring areas in addition to their own output. The result is that drying accommodation has been overtaxed which, together with continuous wet weather during the latter part of the year, led to many complaints of crepe developing mould during drying. Apart from these special circumstances there are indications that trouble with surface mould on crepe increases each year owing to the gradual infection of factories which have previously been immune. The margin of safety in drying crepe at ordinary temperature is comparatively small and, once a drying room becomes infected with mould, the trouble is difficult to overcome.

A series of experiments was carried out during the S.W. Monsoon on drying crepe rubber in warm air. Crepe which had been air-dried for one day after rolling was transferred to the experimental drying house at the laboratories (heated by steam pipes), and drying completed at a temperature of 95°F. Crepe of normal thickness could be dried in 48-60 hours and was attractive in appearance whereas air-dried crepe prepared during the same period was discoloured by mould. Approximately ½ ton of rubber was handled during the trials. It is calculated that a daily crop of 2,000 lbs. crepe could be dried in a building 16 ft. by 16 ft. by 24 ft. high at cost of about 0·1 cent per lb. Provision of this type of drying accommodation is not likely to be considered by estates under present economic conditions but it appears to be a practicable method of eliminating trouble with mould and preparing a product of uniform colour independent of weather conditions.

Distillation of Rubber.—Considerable interest was taken locally in the possibilities of making useful products by the distillation of rubber. In particular a suggestion was made in the Press that melted rubber could be used satisfactorily as a protective paint for ironwork. Tests were made using rubber heated to varying temperatures and treated in different ways but the results were relatively unsatisfactory since the films invariably cracked sooner or later when exposed to sun. It was concluded that the material might be suitable for use on estates where funds are not available for repainting ironwork, but there is little prospect of the commercial utilisation of rubber paint prepared in this crude way. It was pointed out to enquirers that the use of chlorinated rubber as a protective paint is being developed and is likely to provide a new outlet for rubber. A Committee of the Rubber Growers' Association considered the economic possibilities of rubber distillation but concluded that there were no prospests of commercial success with rubber "supplied at ½d. per lb. or even given away".

Latex Shipment.—The direct use of latex in industry has expanded rapidly in recent years and there appears to be every prospect of steady development in this direction. Up to the present comparatively little latex has been exported from Ceylon but a number of enquiries were received from estates during the year and several firms have made trial shipments. There appears to be a fair demand for ordinary ammoniated latex but many of the new applications of latex depend on the use of concentrated latex and large shipments of this product are being made from Malaya.

The most important methods of concentrating latex are by evaporation and by centrifuging in a machine of the milk separator type, both of which processes are covered by patents. According to the latest information licenses cannot be obtained to operate either of these processes on a commercial scale at the present time. This should be regarded as a correction of a remark in the 3rd and 4th (combined) *Quarterly Circulars* to the effect that the holders of the patent for centrifugal concentration are prepared to consider the issue of licences. The question of procuring a centrifugal concentrator for experimental work in Ceylon is under consideration.

Vulcanised Crepe.—Attention has been given to the possibility of preparing vulcanized rubber on estates by the addition of suitable ingredients to the latex before coagulation. Up to a few years ago vulcanization could only be carried out at a comparatively high temperature but the introduction of a class of chemicals known as ultra accelerators has altered the position and vulcanized rubber, suitable for certain purposes, can now be prepared without heat. The use of this process may provide scope for the manufacture on estates of various simple rubber articles such as floor and table mats, the mechanical strength of which is less important than moderate resistance to deterioration.

A number of samples of crepe were prepared from latex to which sulphur, zinc oxide and Z.D.C. accelerator had been added before coagulation. The rubber showed no signs of tackiness on exposure to sunlight and was moderately resistant to the action of organic solvents. Samples of the vulcanizing mixture have been distributed to several estates for trial in the manufacture of rubber mats. Preliminary tests were also made on the vulcanization of latex by the addition of lime-sulphur mixture.

MYCOLOGICAL AND BOTANICAL SUBJECTS.

Oidium Leaf Disease.—The experiment on the control of Oidium leaf disease by sulphur dusting was continued on Kandanuwara Estate, Matale, this being the third year of treatment of the experimental field. Unfortunately mechanical trouble with the motor dusting machine occurred after 2 applications of sulphur had been made and the programme could not be completed. Control of the disease was reported by the Mycologist to be negligible. A new machine of different make has been purchased and is being used for the dusting programme in 1933.

Records of the yield of plots in the dusted and undusted fields were kept during the year and the results will be published shortly. Inspection of

the figures shows that there was not the same increase in yield after the wintering period which was noticeable in 1931 when the dusting was very effective.

Diseases of Budded Plants.—A disease of budded plants leading to dieback of young green shoots from the union was investigated. The dieback was caused by Diplodia but examination of the affected plants showed in all cases a pad of coagulated latex at the junction of the shoot and stock, presumably arising from the presence of an internal fissure. The formation of a fissure was considered to be the primary cause of the disease leading to a rupture of the union through which Diplodia gained entrance. The trouble was confined to plants of which the stock was exceptionally large, resulting in rapid growth of the budshoot and certain clones appeared to be more liable to give trouble than others.

After the exceptional drought in January-February specimens were examined in which the bark of 2-3-year-old buddings had died back near the union. Sun scorch was considered to be the primary cause, followed in many cases by the entry of Diplodia. Most of the plants could be treated by the excision of the diseased tissues.

Bark Renewal Experiment.—An experiment was carried out at Nivitigala Estate to determine the effect on bark renewal of applying mixtures of earth-cowdung and disinfectant to recently tapped panels. Application of the mixtures was made in 1931 and the thickness of bark in the different plots was measured 12 months later. There was no significant difference in bark renewal of trees in the treated and untreated plots and it is concluded that, under the condition of the experiment, application of the mixtures did not influence the rate of renewal. In this case the application was made to cuts which had been closed during the wet season. It is possible that the treatment may serve a useful purpose when applied to cuts closed just before the wintering period, by protecting the bark from strong sunlight. A report on the experiment has been prepared for publication.

Yield Records and Test Tapping.—The number of estates from which yield records of prospective mother trees were received showed a considerable decrease compared with last year figures being :—

		Estates	No. of trees
1932	Regular quarterly records	16	123
	Irregular records	11	67
1931	Total	39	524

Part of the decrease is due to elimination of trees which were not sufficiently promising for further records to be required, but it is mainly due to cessation of tapping on estates or to difficulty being experienced in continuing to keep the records under present conditions. No new estates have undertaken to provide records during the year and only 2 promising trees have been added to the list of prospective mother trees.

From the records available approximately 100 trees have been selected for test when land is available and budwood from most of them is established in the multiplication nursery at Nivitigalakele.

Test-tapping of 6-year-old budgrafts of two promising local clones was carried out by an estate in collaboration with the Research Scheme, the rubber from the trees being forwarded to the laboratories to be weighed. A preliminary report on the trees will be published shortly and arrangements are being made for similar collaboration with other estates where test tapping of budgrafts is in progress.

Tapping Systems.—A large number of estates have adopted "double cut tapping systems" in which the trees are tapped with two half-spiral cuts on opposite sides of the tree, either every third day with a periodic rest or every fourth day without a resting period. The Research Scheme has not yet been in a position to undertake experiments to compare these systems with standard alternate day tapping but has kept in touch with the subject by means of visits to, and reports from, estates where the systems are in use. In reply to numerous enquiries from estates regarding the merits of the systems the opinion has been expressed that either of them can safely be adopted under present conditions with a view to effecting a reduction in tapping costs but that it is too early to say whether the systems are likely to be suitable for permanent adoption. It is uncertain whether the systems will be equally satisfactory under all conditions.

EXPERIMENT STATION, NIVITIGALAKELE.

Budding of the clearings was completed during the year with the exception of 7 plants for which budwood of the appropriate clones was not available. Altogether 123 Ceylon clones and 5 foreign clones are now represented in the field. It may be useful to mention the reason for the

delay in completing the budding of the 1928 clearing. This arises from a decision reached in 1929 to reduce the size of plots from 1 acre to ¼ acre, which involved the selection of a large number of additional mother trees and multiplication of budwood before the clones could be established in the field. The change in arrangements was justified by the increased number of clones which could be tested in the area available.

In a number of budded plants decay of the stock has been found to occur at the junction of the stock and scion, during the period which elapses before callusing of the cut surface is completed. A systematic inspection of the clearings was undertaken and affected plants treated on the lines indicated in the Agricultural Assistant's report. An experiment was started to compare different methods of treatment of the cut surface of stocks, both at the time of cutting down and after decay has occurred and an interim report on the subject was published in the 3rd and 4th (combined) *Quarterly Circulars* for 1932. Observation at the Experiment Station and on estates tends to show that decay of the cut surface indicates a lack of vigour in the plant and can be avoided to a large extent by suitable cultivation prior to budding and when the stock is finally cut back. Apart from casualties to supplies and a certain amount of damage to young budshoots by Phytophthora and insects the only other disease which has occurred during the year is *Coticium salmonicolor* ("pink disease") several cases of which were dealt with. Up to the present no case of root disease has been observed at the Station.

Test-tapping of 55 budded trees and marcots in the 1926 clearing was continued and an additional 57 trees were brought into tapping later in the year. The best individual yield was given by a marcot which averaged 26·75 grams per tapping (April-December). Buddings from this tree were planted out in the 1928 clearing last year. Of the budded trees clone G.771 (7 trees) has given an average of 13·1 grams per tapping.

A few of the budded trees flowered for the first time and the opportunity was taken to start experiments on the cross-pollination of Ceylon clones. A fairly satisfactory proportion of pollinations was successful but in all except one case the seed pods dropped before they matured. Seed from the remaining pod germinated but the plants died. The lack of success is considered to be due to the trees being too young to produce satisfactory seed. Some preliminary tests were made on the propagation of uniform stocks by layering and stooling.

A heavy cover of leguminous plants has been maintained over the greater part of the Station. *Centrosema pvbescens* and *Pueraria phaseoloides* continue to be the most vigorous of the ground covers, while *Clitoria cajanifolia*, *Crotalaria usaramoensis* and *Tephrosia noctiflora* have done well among the erect plants. *Calopogonium mucunoides* forms a heavy cover but dies back during the dry weather. This has possible advantages from an agricultural point of view but it enables weeds and grasses to spread before the Calopogonium seedlings develop after the rains start. Erect cover plants were pruned during the year and the loppings spread at the back of the terraces. Gliricidias were lopped and those which were too near to rubber plants removed. A number of unwanted Albizzias were removed and others lopped at a height of 12 feet. *Mikania scandens* continued to make an appearance among the covers in different parts of the Station but was kept under control by periodical forking. Weeding was carried out at 2-3 month intervals during the year and the Station is in satisfactory condition in this respect in spite of considerably reduced expenditure. Cover crops were allowed to grow over the platforms, a circle of 3 ft. radius round each tree being kept cleared by the weeders.

A small area in the 1926 clearing was manured with a mixture of cyanamide, bone meal and muriate of potash, forked in with green manure loppings. Supplies and newly-budded plants in the 1928 clearing which were not treated last year were also manured. New supplies were given a small application of animal meal at the time of cutting back the stock. Seedling nurseries were manured as found necessary.

ADVISORY WORK, CORRESPONDENCE ETC.

The number of enquiries from estates approximated to that of previous years but the nature of the enquiries formed a reflection of present conditions in the industry. Requests for information on budgrafting and replanting were less in evidence, and were replaced by enquiries relating to new tapping systems, the effect of tapping during the wintering period and similar subjects. On the manufacturing side considerable interest was shown in defects in crepe rubber, both in relation to drying conditions dealt with in a previous paragraph, and also to the possible effects of "double cut" tapping systems on the colour of crepe. Comparison of samples from "double 4" and alternate day tapping showed no material difference under favourable conditions but it is considered that the longer interval is likely to increase the tendency to discolouration during wet weather when tapping is irregular. Discolouration could probably be prevented by hot water treatment of the coagulum. Other enquiries related to shipment of latex and new uses for rubber.

During the absence of Mr. Murray on home leave enquiries on mycological subjects were referred to the Government Mycologist and this opportunity is taken to thank Mr. Park for his helpful co-operation.

Correspondence of the Scheme during the year was as follows:—

	Inward		Outward
Secretarial office (not including printed matter)	310	...	700
Laboratories:—			
Estates and Agencies	953	...	898
General	443	...	312
Head Office	304	...	480
Total	2,010	...	2,390

The following visits to estates were made by Technical Officers:—

	Director	Mycologist.	Agricultural Assistant.
Advisory—Agricultural	5	6	1
Advisory—Manufacture	9	—	—
Experimental	6	2	6
Total	20	8	7

Addresses to Planters' Associations:—

Matale P. A. — *Oidium* Leaf Disease (Mycologist)

Kelani Valley P. A. Alternative Forms of Raw Rubber (Director)

Meetings of the Kalutara P.A. were attended by one or more members of the staff.

The Director was present at Board meetings by invitation, and also attended meetings of the Estate Products Committee of the Board of Agriculture and the Annual General Meeting of the Planters' Association of Ceylon.

VISITS TO LABORATORIES ETC.

Visits to the laboratories were made by the Chairman, an Estate Committee of the Board and several other members of the Board. Other visitors included Colonel Pollitt (Director, Imperial Chemical Industries) and 2 members of the agricultural research staff, Dr. Whitford (Rubber Association of America), Dr. Child (Coconut Research Scheme) and a number of Estate Superintendents and Assistants.

Several members of the staff of the Rubber Research Institute of Malaya were met in Colombo when passing through on home leave. These included Colonel B. J. Eaton (Director), C. E. T. Mann (Head of Botanical Division), R. O. Bishop (Head of Chemical Division), Dr. E. Rhodes, Dr. A. S. Corbet. Such opportunities for personal discussion of current research topics are particularly valuable and provide a sound basis for active co-operation between the 2 Institutes. A regular exchange of views was maintained with Officers of the Malayan Institute during the year.

Mr. G. J. Wehry, a member of the Committee controlling the Research Stations in Java, was met in Colombo and the subject of extended co-operation between the various research organisations was discussed. Mr. Wehry also emphasized the value of personal meetings and hopes to arrange for Officers of the Dutch Research Stations to visit the laboratories when passing through Ceylon.

PUBLICATIONS.

The following publications were issued during the year:—

Bulletin 52.—The Preparation of Uniform Rubber, G. Martin, W. S. Davey and H. C. Baker (Staff of the London Advisory Committee).

Annual Report for 1931.

1st and 2nd Quarterly Circulars for 1932 (combined).

Proved Heavea Clones,	R. K. S. Murray
A Popular account of recent work of the Rubber Research Staff in London on the production of uniform rubber in Ceylon.	G. Martin,
The effect of Hevea latex Lipin on the manipulation of Rubber.	Staff of the London Advisory Committee.
The effects of conditions of storage on the hardness of rubber.	G. Martin and H. C. Baker

3rd and 4th Quarterly Circulars for 1932 (combined).

Alternative forms of raw rubber	T. E. H. O'Brien
Importation of rubber budwood and budded stumps.	R. K. S. Murray
Notes on the after-treatment of budded rubber stocks.	W. I. Pieris

SUMMARY OF WEATHER RECORDS AT THE LABORATORIES.

	1932.	1931.
Rainfall	148·41 in.	142·29 in.
Highest monthly rainfall	26·96 in. (Aug.)	21·87 in. (May)
Highest daily rainfall	5·35 in. (Aug. 25)	4·55 in. (May 3)
Highest shade temperature recorded (day)	95·0°F (Jan. 26)	95·1°F (March 1)
Lowest shade temperature recorded (day	72·9°F Aug. 26)	76·1°F (May 4)
Lowest shade temperature recorded (night)	65·2°F (Feb. 5)	69·2°F (Jan. 30)

(Sgd.) T. E. H. O'BRIEN,
Director of Research.

Research Laboratories,
Culloden,
Neboda, 8th March, 1933.

MYCOLOGIST'S REPORT FOR 1932.

Duties as Officiating Chief Technical Officer were relinquished on Mr. T. E. H. O'Brien's return from furlough on the 18th January. The writer proceeded on home leave on the 8th April and returned on the 2nd January, 1933.

The following is a summary of the subjects which received attention during the short period in which the writer was in Ceylon:—

Oidium Leaf Disease.—Further sulphur dusting experiments in the control of this disease were undertaken on Kandanuwara Estate. After two applications of sulphur had been satisfactorily made, however, the engine of the dusting machine developed ignition trouble necessitating a new condenser being made for the magneto. This involved a delay of 6 weeks covering the important month of February when most of the trees were in young leaf, with the result that the control secured by the treatment was negligible. Further trouble was experienced with the magneto when work was resumed, and it seems that an entirely new magneto is needed. A new machine of different manufacture has been obtained from England on favourable terms for further experiments.

The recording of yields from plots in the dusted and control fields was continued throughout the year. The results have not been fully worked out at the time of writing this report, but will be published in due course. It is evident that although the superior yield of the dusted field has been maintained to some extent, there has not been the same immediate response to the retention of the new foliage in the months immediately following the wintering period as was noticeable in 1931 when the dusting was extremely effective. It is hoped that the dusting operations planned for 1933 will be sufficiently successful to provide confirmatory evidence to the results obtained in 1931.

Small scale tests were carried out at the laboratories with a dusting powder known as "Chemical Sulphur R.V.3", which contains pure sulphur and metallic sulphides. It was found to be highly toxic to *Oidium* and to possess satisfactory physical and cloud-forming properties. It is cheaper than any of the brands of sulphur tried hitherto, and will be used in large scale experiments in 1933.

Proved Clones.—A study was made of the information available regarding the best proved Hevea clones commonly planted in Ceylon. The notes compiled were presented in a paper published in Rubber Research

Scheme combined *Quarterly Circular*, Vol. 8, Parts 1 and 2. This is intended to be the first of a series of notes which will keep planters in touch with the most recent information concerning the clones of chief interest to Ceylon.

Bark Renewal Experiment.—Mention was made in the Mycologist's Report for 1931 of an experiment being conducted on Nivitigala Estate to test the value of applying mixtures of earth, cow-dung and disinfectants to renewing bark. A full report of the experiment has been prepared for publication, and the following is a summary of the experimental details and conclusions:—

Three mixtures were chosen which were thought to be representative of the types in common use on Ceylon estates. All contained earth and cowdung as basic substances; one contained tallow in addition and the third contained tallow, sulphur, copper sulphate and lime. A control, in which no application was made, completed four treatments which were replicated fourfold and arranged in a Latin Square. The size of each of the 16 plots was approximately 60 trees, so that a total of about 960 trees was involved.

The experiment was laid out on a uniform field of well-grown mature rubber. Tapping was stopped on May 31st, 1931, but owing to continuous wet weather the applications could not be made until August. In August, 1932, measurements of the renewing bark of all trees were made by the Agricultural Assistant, and it was found that there was no significant difference between the thickness of bark in any of the treatments.

It is, therefore, concluded that under conditions obtaining during the experiment the application of the mixtures concerned did not prove beneficial to the renewal of the recently tapped cortex. It is possible that such treatment might be of value if carried out immediately before the wintering period in that the recently exposed cortex would thereby be partially shaded from strong sunlight. It would appear, however, that under normal conditions of shade at other times of the year the common practice of applying "sani" to the cuts has nothing to recommend it.

Two Diseases of Buddings.—Arising from specimens received two diseases of young buddings were investigated in the early part of the year.

(1) This was a die-back of young green shoots from the union and was observed on two estates in the Kalutara district and at the Experiment Station, Nivitigalakele, the age of the shoots being 1-6 months. In

all the specimens examined Diplodia was present and was apparently responsible for the die-back up the shoots, entrance having been gained at or near the union. In some cases the tip of the shoot was also withered. The fungus was isolated in pure culture and inoculations made on wounded and unwounded green bud-shoots. From the fact that no infection occurred it was concluded that Diplodia was only secondarily responsible for the diseased condition, and it was necessary to determine the primary factor.

A careful study was made of all stages of the disease in the field. A longitudinal section at the union of affected plants showed in all cases an internal pad of coagulated latex at the junction of the shoot with the stock. It was concluded that this pad was caused by an internal fissure, a phenomenon which has been described in Java by Bobilioff. In all cases the shoot bore a very heavy head of foliage, and it seemed probable that excessive movement of the shoot in the wind, in conjunction with the internal fissure, caused a rupture at the union through which Diplodia gained entrance. The origin of these fissures is not known, but they are possibly connected with very rapid growth, and appear to occur more commonly in certain clones. It is significant that in all the specimens examined the stock was exceptionally large (3-5 years old), resulting in a very rapid growth of the bud-shoot. It is possible that under such circumstances unsatisfactory unions may be somewhat frequent. It would appear that Clone B.D. 5 is particularly liable to the trouble, and it is also interesting to note that all the diseased shoots at Nivitigalakele were of one (Ceylon) clone. It is suggested that with buddings of apparently susceptible clones on very large stocks, one stock-shoot should for some weeks be allowed to grow in addition to the bud-shoot so as to retard the early rate of growth of the latter.

(2) After the exceptional drought experienced in January and February a number of specimens was received in which the bark of 2-3 year old buddings had died back near the union. A study of the disease on an estate in the Ratnapura district showed that the primary cause was sun-scorch, which had caused cracking of the bark on the raised portion of the "elephant foot". In nearly all cases Diplodia had gained entrance with consequent extension of the affected area, but the plants could mostly be treated by excision of the diseased tissues.

Visits to Institutes etc. in England.—While on leave in England the following Institutes were visited:—

Imperial Institute (London Laboratories of Research Scheme)
Imperial Mycological Institute, Kew.
Rothamsted Experimental Station.
East Malling Research Station.
Biological Field Station, Slough.
Messrs. South Metropolitan Gas Company, Ltd.

Three weeks were spent at Rothamsted Experimental Station studying modern methods of field experimentation and the statistical reduction of results. The opportunity was taken of discussing with Dr. R. A. Fisher and other members of the staff the problems of field experimentation with Rubber, and with their assistance designs for manurial trials, tests of clones etc. were worked out. By suitable statistical treatment of certain Rubber data which were available at the station it was possible to show that by carrying out a uniformity trial for one year on the plots to be used in a manuring or tapping trial, the precision of the subsequent experiment can be very materially increased.

Advisory Work.—Visits were made to 6 estates in an advisory capacity. An address on "Sulphur Dusting against *Oidium*" was given at the Annual General Meeting of the Matale Planters' Association.

Specimens and enquiries dealt with amounted to 42. During the writer's absence on leave disease specimens were kindly reported on by Mr. M. Park, Government Mycologist.

PUBLICATIONS.

(1) Proved Hevea Clones.—*Quarterly Circular*, Vol. 9, Parts 1 and 2.

(2) Importation of Budwood and Budded Stumps.—*Quarterly Circular*, Vol. 9, Parts 3 and 4.

(Sgd.) R. K. S. MURRAY,
Mycologist.

Rubber Research Scheme Laboratories,
Culloden, Neboda,
3rd February, 1933.

AGRICULTURAL ASSISTANT'S REPORT FOR 1932.

The duties of the Agricultural Assistant during 1932 have been mainly in connection with the immediate supervision and charge of the Rubber Research Scheme Experiment Station at Nivitigalakele and the accounts and records relating thereto. Visits to estates have also been undertaken from time to time.

THE EXPERIMENT STATION.

The Clearings.—The intention of completing the budding of the 1928 clearing before the end of 1932 has been achieved except in the case of 2 clones for which sufficient budwood was not available. These 2 clones have 7 "holes" to be completed. It will be recalled (vide 1931 report) that at the beginning of the 1932 budding season there were 38 clones to be completed and 3 to be introduced. The clones introduced were "*MK. 11-2*", "*SI. 23*" and "*CL. 4*". Clone "*MK 13-2*" was substituted in place of "*HW. 5*" which was found difficult to bud. The total number of clones in the 1928 clearing is 94. A complete list of clones at the Experiment Station is appended.

The 1926 and 1927 clearings which were completed in 1930 have been maintained so, the former requiring 10 supplies and the latter 20 to replace casualties.

In a number of budded plants in the clearings the point at which the stock had been finally cut off was found after a time to have started to rot. A tree-to-tree examination was undertaken in all clearings and infected joints were cleaned down to healthy wood with a chisel, disinfected with 10 per cent. Brunolinum Plantarium and painted over with Skene's pruning mixture. Where cleaning out left a hollow in which water could lodge, the hollow was disinfected and filled with a mixture of "Colas" road surfacing emulsion and sand (1:2). In this connection an experiment to ascertain (a) the best method of treating already infected joints and (b) the most suitable treatment for preventing infection, was initiated. An interim report on the experiment was published.

Platforms which had tended to flatten were re-sloped to a gradient of 1 in 6 in all clearings.

Budding.—The results of the year's budding (i.e., April to December) are shown below. The corresponding "successful percentages" for the field, supply nurseries and budwood nursery for 1931 were 64, 70 and 55 respectively. While no marked difference is noticeable the figures show

that a fair average has been maintained. It might be mentioned that the figures include budding done by "learners" who have been instructed at the Experiment Station.

	Plants budded	No successful	Percentage successful
Field ...	631	418	66
Supply nurseries ...	1848	1185	64
Budwood Nursery	616	448	72
Total	3095	2051	66·2

An inspection of certain unsuccessful buddings at Nivitigalakele revealed that failure was in many cases due to water entering the bud-patch through the waxed tape bandage, and that the use of a more water-proof bandage during wet weather would be desirable. Accordingly the introduction of a square patch of adhesive tape (specially manufactured for budding) over the bud before binding it with waxed tape was adopted and found to be an improvement.

Pollination.—A few budded trees in the 1926 clearing produced flower for the first time and the opportunity was taken to initiate work in cross-pollinating Ceylon clones. A number of the inflorescences "caged" however shed their flowers without opening, but where this did not happen, 103 "females" were artificially fertilised, of which 7 were successful. 4 out of the 7 successful pods dropped when they were the size of a marble, and 2 later. The remaining pod, which was a cross between "*Marcot 52*" and "*Heneratgoda 2*", matured, and its 3 seeds were successfully germinated. On planting them out in the nursery however they died, due very probably to lack of vigour. The work will be repeated on a larger scale next season.

Clone.	Pollen used	No. pollinated	No. successful	% successful.
H. 2 (tree No. 83)	Marcot 52	24	0	0
H. 2 (tree No. 83)	Lavant 28	27	0	0
Marcot 52	Heneratgoda 2	19	2	10
Marcot 52	Lavant 28	16	0	0
Estate tree	Estate tree	17	5	29
	Total	103	7	7

It will be observed that the more satisfactory results obtained on estate tree suggest that the budded trees were too young to seed freely.

Vegetative Propagation of Stocks.—In view of the experience of East Malling and other fruit research stations in England that the behaviour of a budded tree is influenced by the stock and the resulting importance of providing known uniform stocks for experimental purposes, experiments were conducted at Nivitigalakele in rooting rubber stocks vegetatively (a) by "*stooling*" and (b) by "*layering*". The stooling method consisted of cutting down a number of 2 to 4-year-old rubber plants to 4 ins. or 6 ins. from the ground. The stumps were allowed to shoot and when the shoots were 6 ins. to 2 feet long they were slightly damaged with a knife at the point of union and their lower portions covered with soil in the form of a mound. The shoots of 5 out of 12 stumps rooted. The "layering" method has so far proved unsuccessful. 6 budded plants were carefully uprooted, laid horizontally on the ground and the roots re-buried. The buds along the main stem soon burst and produced shoots, which were damaged at the union and covered as before to induce rooting. No root-formation resulted. The method however cannot be deemed a failure until the experiment is tried on a larger scale.

Cutting Down Stocks.—An experiment to ascertain the difference between cutting down a successfully budded stock 6 ins. above the bud and breaking stock at 3 feet after ring-barking at 6 ins. showed that there was no ultimate difference in the number of buds that sprout but the buds on the stocks cut down to 6 ins. sprouted earlier than the ones ring-barked and broken.

Nurseries.—The major portion of the budwood required for completely budding in the 1928 clearing has been supplied by the Budwood Nursery, and the budwood produced has been invariably good. Systematic pruning has been mainly responsible for the condition of the budwood. All clones introduced into the clearings during 1932 have been reproduced in the budwood nursery besides several other promising Ceylon clones which may be required for expansion of the Experiment Station in 1933. The total number of clones introduced into the nursery during the year has been 49 and the total number of clones in the nursery as at 31st December 1932 was 267. Each clone is allotted a group of 5 plants. The total number of budded plants in the nursery is 1302, and the total number of unbudded stocks 572.

A seedling nursery approximately ¾ acre in extent was established on a sloping piece of ground with contour beds alternating with contour catchment drains to prevent erosion. 15,000 seedlings were planted out,

which in due course will be thinned out to 10,000 or thereabouts for purposes of budding. It is proposed to utilise the plants for distribution as budded stumps to small-holders.

Foreign clones *A.V.R.O.S. 49, 50, 152 and 256, Tjirandji 1 and 16, Bodjong Datar 5 and 10, Sungei Reko 9, Prang Besar 23 and 186, Rubana 393, Glenshield 1, Sabrang 24* and *Tandjong Kemala 12, 14, and 26* were introduced into the nurseries and multiplied for future requirements. 171 selected seed from 12 Malayan high yielding trees were germinated and planted out. Seedlings (approximately 1 year old) from selected Tjikadoe seed were test-pricked, and 168 of them planted out in the field. Test-pricking was carried out with a sharp ¼ in. chisel after smoothing the bark with soft sandpaper and slightly moistening.

Test-tapping.—Test-tapping of the 55 Budded trees and Marcots brought into tapping in 1931 was continued from April to December 1932, tapping every alternate day. To this number, 57 trees were added in September 1932, but the latter were tapped in alternate months only. As an individual tree *Marcot 52* (marcot from seedling stock "*Peradeniya 41*", planted in September 1927) has yielded consistently well averaging 26·75 gms. dry rubber per tapping for the year (April to December 1932). Of the clones, "*G. 771*", with an average of 13·1 gms. has yielded best.

Manuring.—All budded plants in the 1928 clearing which were not manured in 1931 due to the fact that they were then either dormant or recently supplied, were given an average of 1 lb. per tree of a mixture of calcium cyanamide, bone meal and muriate of potash. Green cover crop loppings were forked in with the fertiliser. 3½ acres in the 1926 clearing where growth was poor were similarly manured at the rate of 3 lbs. per tree. All 1931 seedling nurseries were manured prior to the commencement of budding, and supply stumps have been given ½ lb. of animal meal each at time of cutting down stock.

Nitrogenous Plants.—During the year the ground cover has been allowed to grow over the platforms which hitherto have been maintained clean weeded. A radius of 3 feet round each rubber plant however has been kept clear. In most portions of the clearings the cover crop has almost completely covered the terraces thus appreciably reducing weeding costs. Green manures were pruned once throughout the station and loppings were either forked in with artificial fertilisers or spread at the back of the terraces. 242 lbs. of green manure seed was collected, of which 131 lbs. was sold and the balance re-sown.

Gliricidias near rubber plants were rooted out and rows lopped to 3 feet, while overgrown *Albizzias* were cut down to 12 feet.

Weeding.—Weeding has been executed on contract at a much smaller cost than during the previous year both by the reduction of rates and by weeding at less frequent intervals. *Mikania scandens* (loka palu), though favoured by the year's heavy rainfall, was kept in check by frequent rounds of forking. *Imperata arundinacea* (illuk) is rarely come across except in a few places along the boundaries.

Instruction and Demonstration.—Demonstrations in bud-grafting were given to a number of estate superintendents and several interested visitors from other countries, and courses of instruction to conductors and learners from estates.

Pests and Diseases.—Cases of *Corticium salmonicolor* (pink disease) have occurred from time to time but prompt measures were taken to cut well below diseased area and burn. The pink incrustation characteristic of the fungus is tarred over before cutting to prevent the dissemination of spores. Damage to cover crops from the Kalutara snail (*Achatina fulica*) has been occasioned during wet weather and the snail has had to be collected and destroyed in the early mornings. Where the area attacked was not extensive, spraying the cover crop with Bordeaux mixture was found efficacious.

Rainfall.—The rainfall for the year (171·58 ins.) has been well above the average. Details appear below:—

	1932	1931
January ...	·97	... 11·96
February ...	6·25	... 3·06
March ...	9·70	... 9·30
April ...	21·50	... 8·80
May ...	27·76	... 23·10
June ...	10·45	... 17·41
July ...	6·25	... 22·18
August ...	26·20	... 22·02
September ...	11·60	... 15·66
October ...	22·45	... 5·44
November ...	20·05	... 20·32
December ...	8·40	... 10·39
Total ...	171·58	... 169·64

Staff.—The staff, consisting of the under-mentioned, have discharged their duties satisfactorily :—

Mr. S. B. O' Neil, Conductor.
,, H. J. Fernando, Budding Instructor.
,, D. C. Kannangara, Budding Assistant.
,, Y. J. Chelliah, Budding Assistant.

The services of the watchman were discontinued at the beginning of the year for reasons of economy.

GENERAL.

Estates were visited during the year for work in connection with the identification of clones, inspecting and reporting on experiments conducted by the Rubber Research Scheme, selection of budwood, examination of high-yielders, inspection of cover crops, and matters connected with budding and the after-treatment of budded plants.

Publication.—"Notes on the After-Treatment of Budded Stocks" (Rubber Research Scheme *Third and Fourth Quarterly Circulars* 1932).

(Sgd.) W. I. PIERIS,
Agricultural Assistant.

Research Laboratories,
Culloden,
Neboda,
10th February, 1933.

LIST OF CLONES ESTABLISHED AT NIVITIGALAKELE,

1926 CLEARING.

Clone.	Total Plants.	Clone.	Total Plants.
L. 1/15	112	DK. 3513	3
H. 2	115	J. 18	10
G. 771	105	J. 7	10
G. 1836	107	ELAD. 5	96
C. 4	123	DK. 19935	3
LAV. 28	95	W. 197	18
C. 3	78	ST. G. 45	126
C. 5	107	H. 401	13
ELAD. 3	97		

1927 CLEARING.

MIR. 2	38	TAL. 2	80
MIR. 11	50	MK. 10/2	92
FR. 56	78	BS. 5	104
GL. A4	95	KOB. 41	83
YOG. 8Y	68	MAD. 110	64
KOB. 42	121	PG. 4849	98
ELAD. 1	103	YOG. 21Y	128
ELAD. 4	112	MIR. 3	118
PG. 3183	93	MAD. 15	31
YOG. 1H	92	Control	12

1928 CLEARING.

Block.	Clone.	Total plants.	Block.	Clone.	Total plants.
1A.	MK. 3/2	70	46.	BP. 1	29
2A.	MK. 1/1	71	47.	RH. 10	26
3A.	KOS. 6	65	48.	BP. 8	30
1.	H. 24	27	49.	RH. 15	27
2.	WG. 6278	27	50.	BP. 21	26
3.	DK. 5315	25	51.	HUM. 7/1	28
4.	H. 82	29	52.	PAS. 226	25
5.	ST. G. 40	27	53.	GH. 47	25
6.	DBK. 1	25	54.	CG. 37	29
7.	MAD. 18	25	55.	GH. 50	26
8.	H. 140	25	56.	TGK. 1/5	30

1928 CLEARING.—(*Contd.*)

Block.	Clone.	Total plants.	Block.	Clone.	Total plants.
9.	PB. 25	25	57.	GH. 51	29
10.	DK. 19935	28	58.	LBW. 108	28
11.	WP. 24	30	59.	MK. 13/2	26
12.	PB. 23	27	60.	MK. 1/3	29
13.	Control	26	61.	LBW. 147	25
14.	DK. 1	26	62.	YOG. 11T	27
15.	WP. 57	30	63.	PAS. 338	26
16.	DBK. 4	30	64.	YOG. 20Y	26
17.	WP. 76	27	65.	PANA. 34/5	25
18.	MAL. 44A	25	66.	AK. 843	26
19.	DK. 3513	26	67.	EGT. 1	27
20.	ML. 1	28	68.	AK. 18775	26
21.	ELST. 2313/16	26	69.	EGT. 2	25
22.	NAK. 1	25	70.	TEM. 6	29
23.	ELST. 2239/12	30	71.	TR. 4/6	30
24.	NAK. 3	28	72.	TEM. 15	30
25.	WP. 25	22	73.	TR. 6/11	30
26.	NAK. 4	30	74.	WP. 22	26
27.	BS. 3	30	75.	KEP. 3	25
28.	MADD. 3741	28	76.	COD. 2	25
29.	TAL. 4	29	77.	KEP. 7	25
30.	MAD. 22	26	78.	ST. G. 60	27
31.	COD. 3	30	79.	ST. G. 2843	27
32.	HUN. 1391	25	80.	HAP. 33	27
33.	COD. 4	27	81.	AMB. 1	26
34.	FR. 120	27	82.	AMB. 2	27
35.	COD. 5	30	83.	M. 52	27
36.	ST. G. 39	27	84.	CDG. 45	24
37.	LBW. 37	25	85.	PB. 186	27
38.	MKV. 1	30	86.	AK. 18910	26
39.	GL. 6	30	87.	GK. 1	27
40.	K. 1	27	88.	GK. 2	27
41.	HC. 28	28	89.	GK. 4	27
42.	K. 12	26	90.	Control	24
43.	FR. 168	25	91.	MK. 11/2	28
44.	K. 11	29	92.	SI. 23	27
45.	RH. 9	30	93.	CL. 4	26

REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA) FOR 1932.

As indicated in the report of the Ceylon Rubber Research Scheme for 1931 proposals were submitted to the Rubber Research Institute of Malaya and to the Rubber Research Scheme (Ceylon) by their London Advisory Committees that the two organisations should share the cost of maintenance of the Ceylon Rubber Research Laboratories in London (viz. £2,800 per annum), in order to ensure the continuation of the work carried out for many years on behalf of the rubber planting industry. It was suggested that the control of this research should be vested in a Joint Advisory Committee, the constitution of which should be approved by the Boards of the Rubber Research organisations in Malaya and Ceylon, who would also approve the programme of work to be undertaken. It was further suggested that this arrangement should be adopted for a period of three years from the 1st January, 1932 so as to allow the present world crisis to settle down and to afford ample opportunity for the examination and development of the proposals made previously by the Rubber Research Institute of Malaya for (1) a comprehensive scheme of rubber research in the United Kingdom supported by all the interests concerned (including manufacturers) and (2) an international organisation for research on new uses for rubber.

In January, 1932 information was received that the Boards of Management in the East were willing to share the cost of the work in London and a joint meeting of the two existing Advisory Committees was called to arrange for their dissolution and for the appointment of the suggested Joint Committee. At this meeting it was decided to recommend that the new Committee should be constituted as follows:—

1 member nominated by the Colonial Advisory Council of Agriculture and Animal Health.

1 member nominated by the Malaya Governments.

1 member nominated by the Ceylon Government.

3 members representing Malayan planting interests nominated by the Rubber Growers' Association.

3 members representing Ceylon planting interests nominated by the Rubber Growers' Association.

2 members representing manufacturing interests nominated by the Research Association of British Rubber Manufacturers.

and the following *ex-officio* members:—

The Director of the Imperial Institute.

The Director of the Botanical Laboratories, Imperial College of Science and Technology.

The Director of the Imperial Mycological Institute, Kew.

The Director of the Rothamsted Experimental Station.

It was also agreed that a Technical Sub-Committee, to supervise the investigations in London and to consider the technical reports received from the East, on the lines of the previous Technical Sub-Committee of the Ceylon Rubber Research Scheme, should be appointed by the Committee.

Owing to the time necessarily involved in obtaining the approval of the constitution of the new Committee by the Boards of Management in the East and in the appointment of representatives of the organisations concerned, it was not possible to hold the first meeting until the end of May, 1932. A list of members of the Committee and the additional members co-opted on to the Technical Sub-Committee is given on the last page of the report.

At this meeting it was decided to take advantage of the presence in England of two representatives of the Rubber Research Institute of Malaya (Mr. H. B. Egmont Hake and Lt.-Col. B. J. Eaton) to confer with them regarding the proposals of the Institute for the establishment of comprehensive rubber research organisations. As a result of the discussion it was agreed that under existing conditions there is no possibility of obtaining any financial support from rubber manufacturers in this country, and that also a considerable time must elapse before the establishment of an International Board for research on new uses for rubber could be considered. It was agreed, however, that the research in this country on behalf of the planting industry should continue to be carried out in co-operation with rubber manufacturers in Europe and America, and with other possible users of latex and raw rubber products.

It was felt that in view of the type of research problem likely to require attention for some time on behalf of the producing industry, it is of the greatest importance in the first instance to ensure that an effective liaison is maintained between the work of the Technical Research Committee of the Rubber Growers' Association and that carried out in London and in the East on behalf of the rubber research organisations of Ceylon and Malaya. As three members of the Advisory Committee are also members of the Technical Research Committee of the Rubber Growers' Association and there is practically a daily interchange of reports and

information between the Committee and the Association, no difficulty should arise in maintaining the closest contact. In order, however, further to facilitate liaison arrangements were made for the Rubber Growers' Association to be represented on the Technical Sub-Committee by one of its technical consultants (Dr. H. P. Stevens).

The co-operation of the Association has been of great value in the work connected with the processes devised by the staff in London for the preparation of "unvulcanised rubber crumb" a detailed account of which is given in the appendix to this report. Only a limited amount of time and money could be allocated to the study of this problem, and the grant of £350 made by the Rubber Growers' Association rendered it possible to purchase special apparatus and employ temporary assistance so that the experiments could be continued without delay. Copies of a preliminary report on the investigation, which was published in the Bulletin of the Rubber Growers' Association, (November 1932) were forwarded to Ceylon and Malaya for distribution to members of the Boards of Management.

The establishment of a Pension Scheme for the staff had been deferred by the Ceylon Rubber Research Committee in previous years owing to the uncertainty which had existed regarding the continuation of the work in London. The question was reconsidered by the new Committee in view of the altered arrangements as a result of which a scheme was approved, under which payments of 5 per cent. of salary by the staff and a like contribution from the Committee are applied in paying premiums on Endowment or Deferred Annuity Polices maturing at 60 years of age. The Scheme took effect from the 1st January, 1932.

No alterations were made in the permanent technical staff during the year. In view of the shortage of staff in the Chemical Division of the Rubber Research Institute of Malaya, the Committee offered the services of one of the chemists in London for a period of say one year in order to help the Board to overcome any temporary difficulties in dealing satisfactorily with the number of important chemical problems requiring attention under the existing conditions of the rubber industry and also with a view to improving liaison between the work in London and in the East. This offer was however not accepted.

As from 1st May, 1932, the Committee took over from the Rubber Growers' Association the secretarial duties which they had previously carried out on behalf of the London Advisory Committee of the Rubber Research Institute of Malaya and the work as London agents of the Institute for which a payment of £250 a year had been made to the

Association. These new arrangements involved a considerable addition to the office expenses and it was soon necessary to appoint an additional typing and general assistant. It was suggested to the Rubber Research Institute that some special payment should also be made to the Committee for these services but these representations had not met with success by the close of the year.

Mr. H. B. Egmont Hake, Member of the Board of Management, Rubber Research Institute, Lt.-Col. B. J. Eaton, Director of the Rubber Research Institute of Malaya and Mr. R. K. S. Murray, Mycologist, Rubber Research Scheme (Ceylon), attended meetings of the Committee whilst in London, Lt.-Col. Eaton and Mr. R. O. Bishop, Head of the Chemical Division of the Rubber Research Institute also paid several visits to the laboratories in connection with various questions relating to the work in progress in London and in the East. These conferences should prove of the greatest value both to the staff in London and in the East, and may, it is hoped, lead to a fuller appreciation and utilisation by the Rubber Research Institute of Malaya of the services which can be rendered by the London Advisory Committee and its staff.

The expenditure incurred in connection with the work in London during the year amounted to £2,618.1.1. After allowing for liabilities outstanding at 31st December, 1932, there was an unexpended balance in London of £150.0.0. and there was also a balance of £118.15.4. held on behalf of the Rubber Research Institute of Malaya from the funds supplied by them to meet expenditure incurred on behalf of the Institute.

Particulars of the investigations completed and in progress during the year are given in the appendix. The following reports were forwarded to Ceylon and Malaya:—

1. *Clone Rubber.*—A series of 190 samples was received from the Rubber Research Institute of Malaya for tests on the quality of the rubber from the clones available on Pilmoor estate.

2. *Effect of paranitrophenol and gambier on ageing properties of sheet rubber*—12 samples were received from the Rubber Research Scheme (Ceylon) in connection with the work by Mr. O'Brien on the most economical method of drying sheet rubber.

3. *Crepe from coagulum treated with hot water*—with a view to preparing in Ceylon a uniform type of soft rubber.

4. *Standardisation of methods of testing*—investigations in conjunction with the Proefstation at Buitenzorg, Java and the Rubber Research Institute of Malaya.

5. *Examination of latex preserved with ammonia*—reports forwarded at intervals throughout the year.

6. *Air-dried sheet.*

7. *Up-river fine para.*

No report dealing with the detailed examination of the effect of 'reclaim' on the manipulation of rubber was issued as it was considered preferable to defer publication in the East until a paper could be read before the Institution of the Rubber Industry where the matter could be discussed fully with rubber and reclaim manufacturers. Arrangements have been made for a paper on the subject to be read at a meeting of the London section of the Institution in March, 1933 after which it is proposed to prepare for circulation at an early date a popular summary of the paper and of the views expressed during the discussion.

During the year an investigation of over 300 estate samples from Ceylon received in connection with the detailed study of variability of Ceylon rubber has been in progress. This investigation is nearly completed and a report will shortly be forwarded to the Boards of Management. A large amount of interesting data has been obtained; the results are being analysed and proposals for action on estates producing abnormal rubber are under review.

As indicated above special attention has been devoted to devising and developing processes for the preparation of unvulcanised rubber crumb ("powdered rubber") and to studying the possibility of its use in the rubber and other manufacturing industries in Europe and America. Already over 50 samples have been supplied to firms and organisations interested in the product. The replies so far received indicate that this material is not likely to be employed successfully in the rubber manufacturing industry except for special purposes. A few preliminary reports have been received from possible users in other industries and some of these are definitely promising. The work is still in progress and not yet ready for publication.

After discussion with the Director of the Rubber Research Institute of Malaya, a programme of research in London for the years 1932-1935 was prepared and forwarded to Ceylon and Malaya for approval. The principal aims of the work in London may be classified as follows:—

1. Co-operation with Staff in the East with regard to the following problems—
   (a) The preparation of rubber with properties which render it more suitable for particular purposes.
   (b) The effect on the suitability of rubber for manufacturing purposes of economies in preparation.
   (c) The preservation, concentration, transport and general suitability of latex.
   (d) The effect of agricultural factors on the quality of rubber e.g., clone rubber.
   (e) The effect of storage on the quality of rubber prepared by different methods.
2. A study of the effect on quality of factors which have become important owing to recent developments in the rubber manufacturing industry e.g.,
   (a) The relation of serum substances to "scorching".
   (b) The effect of storage under a variety of conditions on plasticity.
   (c) The effect of serum substances on the vulcanisation of accelerator mixings.
   (d) The effect of degree and type of oxidation of raw rubber on the tensile strength and ageing properties of vulcanised rubber.
3. Arrangements with individual manufacturers for trials of special types of rubber viz:—
   (a) Rubber Crumb
   (b) Boiled rubber
   (c) Nitrite rubber
   (d) Creamed latex
4. Co-operation with the Research Association of British Rubber Manufacturers in the production of rubber for special purposes e.g., ebonite.

5. Collection of information concerning the utilisation of rubber and latex with a view to ensuring that new developments (particularly those outside the rubber manufacturing industry) are receiving the necessary attention as regards the suitability of rubber at the producing end.

(Sgd.) P. J. BURGESS,
Chairman.

(Sgd.) J. A. NELSON,
Secretary.

Imperial Institute,
South Kensington, S.W.7.,
16th March, 1933.

LONDON ADVISORY COMMITTEE.

The composition of the London Advisory Committee for Rubber Research (Ceylon and Malaya) at the end of 1932 was as follows:—

Member nominated by the Colonial Advisory Council of Agriculture and Animal Health.

Mr. F. A. Stockdale, C.M.G., C.B.E.

Member nominated by the Government of Ceylon.

Lt.-Col. Sir David Prain, C.M.G., C.I.E.

Member nominated by the Governments in British Malaya.

Mr. J. Lornie, C.M.G.

Members representing Malayan Planting interests—nominated by the Rubber Growers' Association.

Mr. P. J. Burgess, (Chairman)
Mr. W. J. Gallagher,
Mr. H. Eric Miller.

Members representing Ceylon Planting interests—nominated by the Rubber Growers' Association.

Sir Herbert Wright,
Mr. G. H. Masefield,
Mr. George Brown.

Members representing Manufacturing interests.

Lt.-Col. J. Sealy Clarke,
Mr. F. D. Ascoli, C.I.E.

Ex-Officio Members:—

Lt.-Gen. Sir William Furse, K.C.B., D.S.O., Director of the Imperial Institute.

Professor V. H. Blackman, Director of the Botanical Laboratories, Imperial College of Science and Technology.

Dr. E. J. Butler C.M.G., C.I.E., Director of the Imperial Mycological Institute.

Sir John Russell, O.B.E., Director of the Rothamsted Experimental Station.

The Technical Sub-Committee consisted of members of the Advisory Committee with the following co-opted members:—

Mr. G. Martin (Superintendent of Rubber Investigations)
Mr. B. D. Porritt
Mr. I. D. Patterson
Mr. H. W. Ridley
Mr. W. C. Smith
Dr. D. F. Twiss

APPENDIX TO REPORT OF THE LONDON ADVISORY COMMITTEE FOR 1932.

I. Type of Raw Rubber Required by Manufacturers.

Recent development in the rubber manufacturing industry have led to the expression of a variety of views, in some cases contradictory, as to the types of raw rubber best suited to manufacturers, with the result that the research organisations in the rubber growing industry have been handicapped considerably in their work on the preparation of rubber of the required quality.

A memorandum was accordingly prepared on the subject, based on the experience derived by the staff of the Committee from personal contact with individual manufacturers and on information obtained as a result of previous investigations of the Ceylon Rubber Research Committee. This memorandum was submitted to a large number of manufacturers in Europe and America and to the Research Association of British Rubber Manufacturers, and from the data furnished it was possible to formulate a practical scheme of investigation with a view to satisfying most of the individual requirememts of manufacturers.

The three principal requirements of manufacturers appeared to be:—

1. Rubber which is essentially reliable and uniform during manipulation, vulcanisation, and during subsequent use.
2. Uniformly hard, soft and very soft rubber with distinctive differences in appearance to avoid confusion and consequent difficulty during manufacturing operations.
3. Rubber with little tendency to absorb water.

These particular requirements have been under investigations for some time, and the progress made during the year is summarised below.

(1) Uniformity.

A detailed study of the variability of rubber from most estates in Ceylon was nearly completed at the close of the year. The investigation has involved a considerable amount of work owing to the large number of samples (over 300) and the different properties which required examination. The samples supplied by some of the estates differ markedly from the average, but definite conclusions cannot be drawn until the investigations have been completed and the results analysed. They are expected to give full information concerning the variability now experienced by

manufacturers using Ceylon rubber, and it is proposed to supplement the investigation with a study of the methods of preparation adopted on the estates supplying abnormal rubber with a view to modification, if necessary, in the interests of the uniformity of Ceylon rubber.

(2) **Manipulative Properties.**

The experiments so far carried out on the preparation of soft rubber may be classified under the headings—(a) Appropriate chemical treatment of latex. (b) Hot water treatment of coagulum. (c) Oxidation of rubber after disintegration into a finely divided form. In addition experiments have been carried out on allied problems connected with (d) changes in plasticity on keeping, and (e) the use of reclaim to improve the manipulative properties of crepe and sheet.

There is not the same demand for hard as for soft rubber, and the study of the methods of preparing hard rubber was accordingly deferred. Proposals were communicated to the Research Officers in Ceylon and Malaya for their co-operation in work on the subject during 1933.

(a) The method of preparing soft rubber by a chemical treatment of preserved latex without oxidation referred to in the report for 1931 was further developed during the year and samples obtained from fresh latex were forwarded by Mr. O'Brien for examination in London. Although these were found unsuitable for most purposes for which crepe or sheet are employed, some manufacturers are interested in the rubber and claim that it gives good results when treated by special methods. A consignment is being prepared in Ceylon for technical trials.

(b) In view of the promising results of the previous experiments on the effect on plasticity of immersing the coagulum in hot water further samples were examined and the results confirmed that this treatment causes crepe to be uniformly soft and easily masticated. Although crepe prepared by this method is not softer than occasional consignments of first grade crepe and sheet it should be uniformly plastic and, if this method of preparation were generally adopted, the difficulties now caused by occasional consignments of hard crepe should be avoided. A consignment of the rubber is also being forwarded from Ceylon for technical trial.

(c) Considerable interest is being displayed in Europe in "softened" rubber prepared by the oxidation of disintegrated rubber (E.P. 368902, 1931 Ungar and Schidrowitz). Samples of this rubber which were examined were found to be extremely soft and they extruded easily with little recovery of shape. The results of the vulcanising and ageing tests so far carried

but indicate that the conditions of oxidation may affect the relation between the softness of raw rubber and the properties of the vulcanised product. The investigation is being continued.

(d) One of the greatest difficulties in producing a uniformly hard or soft rubber is that rubber may change on keeping. It was previously found that rubber tends to become hard in the complete absence of moisture and that softening is induced by oxygen and accelerated by increasing the temperature. Further investigations shewed that the serum substances tended to prevent its softening in air and that the accessory substances soluble in acetone had the opposite effect. This work has so far served to define the factors affecting the changes in the hardness of rubber on keeping and they indicate that a definite balance of water-soluble and acetone-soluble non-rubber accessory substances may be necessary to produce a rubber which does not change on keeping. Most rubber becomes hard on keeping in Europe so that a reduction in the amount of water-soluble substances should be an advantage from this point of view. This investigation is being continued.

(e) The merits of reclaim have received a considerable amount of publicity in the technical press but little scientific evidence has been published to support these statements. A wide selection of grades of reclaim mixed with raw rubber with and without compounding ingredients was accordingly submitted to the following tests, viz, mastication, power consumption, recovery, deformation and extrusion. It was found that the advantages of adding reclaim to the mixtures are not so definite as has been suggested. The most expensive grades of reclaim hindered the mastication, extrusion and deformation of rubber, but the cheapest grades effected a small improvement.

An important advantage of reclaim demonstrated by these experiments is that mixtures of rubber and reclaim do not recover from deformation to the same extent as rubber alone. On the other hand oxidised rubber behaves similarly to reclaim in respect of recovery from deformation and is much superior as regards ease of deformation generally. These results are being given wide publicity in order that manufacturers may have an opportunity of discussing the results obtained.

(3) Water Absorption of Rubber.

A study has been made of the amount of water absorbed by the comprehensive range of samples obtained from Ceylon for tests on uniformity. The investigation was nearly complete at the end of the year. It was

found that some samples of rubber absorbed much more water than others under fixed atmospheric conditions and proposals for further work have already been forwarded to the East.

Co-operation was maintained with the Research Association of British Rubber Manufacturers and the Electrical Research Association in their joint investigations on ebonite. Their work will eventually involve a study of the effect on the quality of ebonite of rubber prepared so as to absorb as little moisture as possible.

II. Rubber Crumb.

The cost of rubber manufacturing is high relative to that of raw rubber. Consequently cheap raw rubber is not as helpful as the grower would desire in promoting the production of cheap rubber articles. A method of eliminating the need for heavy machinery would be to prepare rubber in the form of powder so that it can be mixed with vulcanising and compounding ingredients merely by shaking, after which it can be pressed into moulds and vulcanised under pressure so that the particles amalgamate together to the shape required. A chemical process of preparing rubber crumb from latex has been devised by the staff in London and is being developed by Mr. O'Brien in Ceylon. Mechanical methods of preparing rubber crumb from latex or dry crepe have also been devised by the staff in London. Applications for British patents have been made (Nos. 3, 198/32, 11, 717/32 and 34, 181/32 respectively), but it is not proposed to restrict the use of these processes. The work in London has been concentrated on the mechanical process. The particles obtained by this method vary from 1/32 inch diameter to a fine dust. Even if the fine dust were separated from the coarser particles by sieving, the finest particles would still be much larger than the rubber particles in latex. Fortunately sulphur and a number of accelerators, antioxidants, colouring materials, etc., are soluble in rubber, and it has been found that there is a wide range of materials which on mixing with rubber crumb by the simplest means form on vulcanisation excellent products.

The preliminary experiments shewed that the principal difficulty in using the crumb is that when it is mixed by stirring with finely divided mineral powders such as zinc oxide or carbon black the powders coat the particles of rubber and interfere with their amalgamation during vulcanisation. The amount of mineral powder which can be incorporated with rubber crumb without seriously interfering with the strength of the vulcanised product depends upon the size of the particles, temperature, pressure and rate of vulcanisation. No difficulty is experienced with 5

parts of zinc oxide per 100 parts of rubber using an ordinary screw press and vulcanisation temperatures as low as 126°C.

The experiments of the London staff have also shewn that the crumb can be used to produce:—

(a) Artistic mottled surfaces.

(b) A new type of sponge rubber.

(c) Rubber-covered fabrics without rubber solvents or latex.

There are many other directions in which a use may be found for crumb powder and a promising line of investigation is the direct chemical treatment of the crumb or solution of the crumb in suitable organic materials such as asphalt. However cheaply rubber crumb can be made, and whether it be made from fresh latex in the East or from dry rubber in Europe and America, it is necessary to assume that it will be at least slightly more expensive than crepe or sheet. The price and the limited extent to which it can be compounded will restrict the use of the crumb for purposes where crepe or sheet are now employed, but there are other purposes for which the granular form is of vital importance, and should be of value in extending the market for materials containing rubber.

III. Experiments Initiated in the East.

(a) Clone Rubber.

In continuation of the previous investigation of clone rubber in association with the Proefstation West Java at Buitenzorg, two further samples from well-known clones were received from Java for examination. On the whole the results of the tests were similar to those obtained previously but it would not be possible to draw general conclusions on tests on clone rubber until the samples can be prepared from mature trees by the methods officially recommended for estate crepe or sheet; these should however be available shortly.

A set of 190 samples of sheet was received from the R.R.I. (Malaya), each representing the product of a single day's tapping during August, October and December, 1931 of six clones and a control block on the Pilmoor Estate. Composite samples from each clone for each month vulcanised quickly and were satisfactory with regard to plasticity, tensile strength and ageing. The results of hardness and rate of vulcanisation tests on individual samples showed that they were satisfactorily uniform.

(b) **Air-dried Sheet.**

During the year further samples were received from Mr. O'Brien in connection with the experiments carried out in Ceylon on the most economical method of drying sheet rubber. The examination of these samples confirmed the previous conclusion that although paranitrophenol, which was used to prevent mould, had little effect on the ageing properties of sheet dried in smoke, it had a harmful effect on sheet dried in air. There was, however, little tendency for mould to develop in the absence of paranitrophenol when the sheet was dried at temperature of 100°F and over.

It is of interest that sheet dried in warm air which is being prepared in Malaya without paranitrophenol does not cause any difficulty as regards mould. Sheets received from manufacturers in the United Kingdom were of good appearance, but no samples prepared under scientific supervision with smoked sheet control for comparison have been sent for examination and it is not possible to draw general conclusions regarding the quality of this form of sheet from Malaya. One of the above samples received from a rubber manufacturer vulcanised unsatisfactorily in a popular type of accelerator mixing and the manufacturer stated that all the air-dried sheet from this estate behaves similarly.

It is evident (1) that the quality of air-dried sheet prepared in Malaya requires study and (2) that it is undesirable to use paranitrophenol to prevent the development of mould in unsmoked sheet.

(c) **Standardisation of Methods of Testing.**

Attention has frequently been called to the advantages to be derived from using identical vulcanisation tests in rubber-sulphur mixings at the official research stations in the East and London. In accordance with the arrangements made at the conference of rubber technologists in Java in 1929 investigations were carried out during the following year in conjunction with the Proefstation at Buitenzorg with a view to determining the extent of the agreement between results of tests on a sample of rubber when the same methods were employed in Java and London. In view of the differences in the results obtained, the investigation was extended and further duplicate tests carried out. The principal differences now found are (1) a slightly higher temperatures (0·3°C) is required in London to obtain the same chemical and physical state of vulcanisation as in Java; this may be due to a slight change in the rubber during transit from the East and (2) tensile strengths are lower in London than in Java. Continuation of the work is dependent upon the extent to which the Research

Stations are able to devote time to the subject, having regard to the demands of other important problems under investigation. Co-operation in this matter with the Rubber Research Institute of Malaya was under discussion at the close of the year with members of the technical staff of the Institute on leave in this country and it is hoped that it may be possible to arrange for the results of vulcanisation tests in Malaya and London to be reported on similar lines.

(Sgd.) P. J. BURGESS,
Chairman.

(Sgd.) J. A. NELSON,
Secretary.

Imperial Institute,
South Kensington, S.W.7.,
29th March, 1933.

RUBBER RESEARCH SCHEME (CEYLON). AUDITOR-GENERAL'S REPORT FOR 1932.

Audit Office,
Colombo, 18th March, 1933.

The Board of Management,
Rubber Research Scheme,
Peradeniya.

Gentlemen,

I have the honour to report that the audit of the accounts of the Rubber Research Scheme for the year 1932 has been completed and have pleasure in forwarding the following documents duly certified:—

(a) Income and Expenditure Account for the year 1932.

(b) Balance Sheet as at December 31, 1932.

I. Income.

2. The total income accrued during the year amounted to Rs. 149,266. It fell below the original estimate of Rs. 162,350/- by Rs. 13,084/- but exceeded the revised estimate of Rs. 105,053/- by Rs. 44,213/-. Compared with the income of the previous year there is a drop of Rs. 28,158/- which is due to a decrease in the cess collections.

3. *Cess Collections.*—The amount accrued for the year was Rs. 140,747/- inclusive of the collections made by the Principal Collector of Customs during December, 1932, but received in January, 1933. It fell below the original estimate of Rs. 155,000/- by Rs. 14,253/- and the collections of the previous year by Rs. 29,847/-. The drop in the collections is due to decrease in the quantity of rubber exported.

4. *Rent of Bungalows.*—The amount recovered during the year was Rs. 153/- as compared with Rs. 897/- recovered during 1931. The decrease is due to the fact that the bungalows are now given to officers free of rent.

5. *Interest.*—The amount accounted for the year was Rs. 8,015/-. It exceeded the estimate of Rs. 6,500/- by Rs. 1,515/- and the interest accrued in 1931 by Rs. 2,824/-. The increase is due to the larger amounts placed in fixed deposit.

6. *Subscriptions and Sale of Publications.*—The amount realised for the year was Rs. 213/- as compared with Rs. 599/- of the previous year.

II. Expenditure.

7. The total expenditure on Revenue Account exclusive of the amount allowed for depreciation on capital assets amounted to Rs. 76,337/- as compared with Rs. 85,686/- of the previous year. Details of this expenditure are fully set forth in the Income and Expenditure Account. The amount written off as depreciation was Rs. 5,895/-. The expenditure charged to Capital Account amounted to Rs. 8,662/- inclusive of Rs. 6,213/- spent on account of the Development of Experiment Station.

8. A statement showing the excesses and unspent balances on votes with the explanation of the Director of Research for the principal variations is given below. Sanction for the excesses has to be obtained.

	Original Estimate	Revised Estimate	Actual Expenditure		Savings	Excess
			Rs.		Rs.	Rs.
	Rs.	Rs.	Rev. a/c.	Cap. a/c.		
1. Personal Emoluments :—						
(a) 1-6 Technical officers	66,038	33,338	33,185	—	153	—
(b) 7 Secretary.	4,500	4,500	3,675	—	825	—
(c) 8-14 Subordinate staff.	7,704	6,693	6,085	—	608	—
(d) 15 Rent Allowance	881	881	717	—	164	—
(e) 16 Provident Fund contribution	3,205	1,570	175	—	1,395	—
(f) 17 Pensionary contribution on Secretary's salary.	360	360	270	—	90	—
II. Other Charges :—						
(a) 18 Laboratory :						
A. Upkeep, Chemicals and Apparatus	2,850	2,000	444 + 841		715	—
B. Apparatus from London.	1,000	1,000	733 + 446		—	179

	Original Estimate	Revised Estimate	Actual Expenditure		Savings	Excess
			Rev. a/c.	Cap. a/c.		
	Rs.	Rs.	Rs.		Rs.	Rs.
C. Samples for Imperial Institute	500	500	99	—	401	—
D. Dusting Experiments	600	600	595	—	5	—
E. Routine tests on Chemicals	200	200	15	—	185	—
F. Manuring Experiments	1,800	—	—	—	—	—
(b) 19 A-E Buildings	3,100	2,250	1,316 +	637	297	—
(c) 20 Office :—						
A. Printing and Advertising	1,800	1,800	804	—	996	—
B. Stationery	1,200	1,200	980	—	220	—
C. Postages	1,200	1,200	736	—	464	—
D. Books and Periodicals	500	500	443	—	57	—
E. General Charges.	600	600	918	—	—	318
F. Audit and Accountancy	300	300	174	—	126	—
G. Furniture	1,000	500	—	175	325	—
H. New typewriter	350	350	—	350	—	—
I. Telephones	335	635	514	—	121	—
(d) 21. Travelling :—						
A. Staff	8,250	4,000	2,780	—	1,220	—
B. Board members	1,000	1,000	787	—	213	—
C. Passages from England.	4,200	—	—	—	—	—

	Original Estimate	Revised Estimate	Actual Expenditure		Savings	Excess
	Rs.	Rs.	Rs.		Rs.	Rs.
			Rev. a/c.	Cap. a/c.		
(e) 22 Experiment Station :—						
A. Development and Upkeep	6,513	6,513	101+6,213		975	—
B. Drainage and extension	775	775				
III. Special Charges :—						
(a) 23 London Advisory Committee's expenditure.	32,400	18,699	19,289	—	—	590
(b) Grants to Research Institutes.	—	1,500	1,500	—	—	—
IV. Depreciation.	—	—	5,895	—	—	—

Savings.

I (b) Due to change in the arrangements for secretarial work from October, 1932.

I (c) Due to appointment of one of the clerks on a lower scale than that provided and to discontinuance of one peon.

I (e) Due to the Board's contribution for 1932 not being due until January 1, 1933.

II (a) A, C and E. Due to the postponement of experimental work.

II (c) A, B and C. Due to reduction in number of publications and to economies.

II (d) A and B. Due to reduction in rates of allowances and reduced travelling.

II (e) Due to reduction in frequency of weeding rounds and to savings on the vote for travelling expenses.

Excesses.

II (c) E. Due to expenses of transferring the Head Office to Culloden (Rs. 204) and to an under-estimate of general transport expenses.

III (a) Due to the settlement in 1932 of certain liabilities of 1931 which the London Committee had not reported when the final accounts for that year were prepared.

III (b) Sanctioned during the year (i.e. on 1-7-32).

IV Not provided for in the estimates.

The sanction has also to be obtained for the excesses on the following sub-heads under the vote for Experimental Station Development :—

		Rs. cts.
(16)	Cart Roads	·43
(4)	Fences and boundaries	1·31
(10)	Nitrogenous plants	35·37
(12-13)	Budding	59·14
(14)	Labels	7·65

9. *Depreciation.*—As regards depreciation it is noted that the suggestion of this Department to show the deductions in a Reserve Account has been agreed to and will be adopted as from 1933 and that provision for same has been made in the estimates for 1933. It is not therefore proposed to insist on the sanction of the Board of Management being obtained in respect of the amounts written off for depreciation in 1931 and 1932.

III. Balance Sheet.

(a) Liabilities.

10. *Sundry Creditors.*—Rs. 1,500/-. So far as it can be ascertained all outstanding liabilities on December 31, 1932, have been brought to account with the exception of the cost of audit for 1932 amounting to Rs. 246.

11. *Reserve Furd for Bonus and Passages.*—The balance of this account on December 31, 1931, was Rs. 12,280/-. Of this amount a sum of Rs. 4,081/- was paid to two officers as bonus due to them under their old agreements and a sum of Rs. 2,244/- was spent in providing return passages to England for an officer and his family. There was no addition to this fund during the year. The balance of the account on December 31, 1932, was Rs. 5,955/-.

12. *Provident Fund.*—Rs. 1,827/-.—This balance on December 31, 1931, was Rs. 175/-. The members' contributions to the fund during the year amounted to Rs. 1,477/-. The Board's contribution was Rs. 175/-. A detailed check of the members' accounts was made.

13. *Permanent Reserve Account.*—Rs. 46,550/-. This balance is being carried forward for the last few years.

14. *Experiment Station Reserve Account— Rs. 90,984/-.*—This represents the total capital expenditure in the development of the Experiment Station.

15. *London Plant Reserve Account—Rs. 6,484/-.*—This represents the increase in the value placed on the London Vulcanisation Plant at a valuation held in 1930.

16. *Saleable Books Reserve Account.*—The balance of this account on December 31, 1931, was Rs. 4,630/-. It has been reduced to Rs. 4,587/- by the sale of books to the value of Rs. 43/- during the year.

17. *Surplus Account.*—The excess of revenue over expenditure during the year exclusive of the expenditure on development of the Experiment Station was Rs. 67,034/-. The Capital expenditure on Experiment Station amounted to Rs. 6,213/-. The net surplus for the year therefore was Rs. 60,821/-. This is added to the amount brought forward from 1931, leaving a total surplus of Rs. 241,455/- on December 31, 1932.

(b) Assets.

18. *Land Acquisition—Rs. 984/-.*—This is a balance carried forward from the previous year. No expenditure was incurred during the year on this account.

19. *Buildings.*—The balance on December 31, 1931, was Rs. 47,735/-. A sum of Rs. 2,387/- was written off for depreciation and a sum of Rs. 400/- being the cost of a brick machine purchased during the year was added to this account. The reason given for the purchase of the machine was that it was available at half list price and that the Scheme would be undertaking building operations as soon as its policy was settled. In the meantime the machine is being used in connection with repairs to existing buildings. I have also been informed by the Chairman that the purchase was not specifically sanctioned by the Board but that he approved its purchase from funds available under the vote for upkeep of buildings. It seems rather doubtful that the machine will be of much practical use at any rate for the present in view of the Scheme's limited building operations.

20. *Laboratory Apparatus.*—The balance on December 31, 1931, was Rs. 4,870/-. After writing off 25 per cent. for depreciation and adding Rs. 1,287/- as expenditure during the year, the account on December 31, 1932, stood at Rs. 4,939/-.

21. *Water Supply.*—The balance on December 31, 1931, was Rs. 2,080/-. Ten per cent of this amount was written off for depreciation, leaving a balance of Rs. 1,872/-.

22. *Furniture, Fittings and Office Equipment—Rs. 7,059/-.*—The balance at the end of the previous year was Rs. 7,330/-. A sum of Rs. 733/- was written off for depreciation and a sum of Rs. 300/- was deducted, being value of a typewriter sold. An iron safe, a new typewriter and certain bath fittings were purchased during the year at a cost of Rs. 762/-. A departmental verification of all the inventory articles was held during the year and a report forwarded to this Office.

23. *Development of Experiment Station.*—The expenditure under this head during the year amounted to Rs. 6,313/-. Of this amount Rs. 101/- representing upkeep charges in respect of buildings has been written off against revenue, and the balance of Rs. 6,212/- has been added to the figure of Rs. 84,772/- at which the Development Account stood at the end of 1931 making a total of Rs. 90,984/-.

24. *Saleable Books—Rs. 4,587/-.*—The balance on December 31, 1931, was Rs. 4,630/-. A sum of Rs. 43/- was realised by sale during the year.

25. *London Plant—Rs. 7,967/-.*—The balance at the end of 1931 was Rs. 9,317/-. A sum of Rs. 1,350/- has been written off as usual for depreciation, but it seems rather a large sum to write off when compared with the book value of the plant. Further it may be considered whether in view of the fact that the plant is utilised by the London Advisory Committee for Rubber Research work on behalf of Ceylon and Malaya, the latter should not contribute something towards depreciation on the plant.

26. **Advances:**

(a) *Insurances.*—The relative policies have been inspected and the amounts carried forward in respect of the unexpired portion of the premia paid have been verified.

(b) *Telephone Rents.*—The proportionate amounts of the rents paid for the periods extending into 1933 have been calculated and brought to account under advances.

27. *Deposits.*—The sum of Rs. 30/- represents amounts paid to the Post Office at Neboda as deposits for trunk calls and phonograms.

28. *Sundry Assets at Experiment Station—Rs. 67/-.*—This represents the balance in the amount advanced for expenditure at the Experiment Station. This sum was verified.

29. *Sundry Debtors— Rs. 14,992/-.*—Of this sum Rs. 12,623/- was due from the Deputy Financial Secretary on account of cess collections made during December, 1932. This was received from him in January, 1933. Rs. 2,369/- is the accrued interest to December 31, 1932, on Fixed Deposits which would mature during 1933.

30. *Cash Account—Rs. 219,904/-.*—Receipts for the amounts lying in Fixed Deposit were inspected. The balance in current account was verified with reference to Bank Certificate.

IV.

31. The accounts were received quarterly and examined in this office. The office at Peradeniya was visited thrice and the office at Culloden Estate, Neboda, once. The books and accounts kept at these offices were checked in detail and the cash balances verified.

I am, Gentlemen,

Your obedient Servant,

(Sgd.) J. JOS. JACOB,

Acting Auditor-General.

		7,966 67
Payments in Advance:—		
Insurance and Telephone rent		209 88
Deposits:—		
As per Balance Sheet, December 31, 1931.	25 00	
Additional deposit on phonograms in 1932.	15 00	
	40 00	
Less amount recovered from P.M.G. in respect of Peradeniya office	10 00	
		30 00
Sundry Assets at Experiment Station:—		
Cash in hand		66 71
Sundry Debtors:—		
Cess Collection for December and arrears	12,622 77	
Interest accrued on Fixed Deposits	2,369 42	
		14,992 19
Cash:—		
On Fixed Deposit at National Bank of India Ltd, Colombo	80,000 00	
On Fixed Deposit at Mercantile Bank of India Ltd, Colombo	75,000 00	
On Fixed Deposit at Chartered Bank of India, Australia and China, Colombo	10,000 00	
On Fixed Deposit at Imperial Bank of India, Colombo	20,000 00	
On Fixed Deposit at Hongkong and Shanghai Banking Corporation, Colombo.	20,000 00	
On Current Account	14,853 04	
On hand	51 06	
		219,904 10
Total	399,343 52	Total 399,343 52

T. E. H. O'Brien,
Director of Research,
Rubber Research Scheme (Ceylon).

I hereby certify that the accounts of the Rubber Research Scheme for the year 1932 have been audited and that in my opinion the above Balance Sheet correctly sets forth the position of affairs as shown by the books at December 31, 1932.

Audit Office,
Colombo, 18th March, 1933.

(Sgd.) J. JOS. JACOB,
Acting Auditor-General.

RUBBER RESEARCH SCHEME (CEYLON).

Income and Expenditure Account for the Year ended 31st December, 1932.

DR. CR.

RUBBER RESEARCH SCHEME (CEYLON).

Balance Sheet December 31, 1932.

LIABILITIES.

	Rs. cts.	Rs. cts.
Sundry Creditors:—		
Experiment Station	72 26	
Local Accounts	1,427 91	
		1,500 17
Reserve Fund for Bonuses and Passages:—		
As per Balance Sheet, December 31, 1931.	12,280 40	
Less payments during 1932	6,325 00	
		5,955 40
Provident Fund Reserve Account:—		
As per Balance Sheet, December 31, 1931	175 00	
Addition during 1932.	1,652 05	
		1,827 05
Permanent Reserve Account:—		
As per Balance Sheet, December 31, 1931.		46,550 00
Experiment Station Developmnt Reserve Account:—		
As per Balance Sheet, December 31, 1931	84,771 58	
Expenditure on Development January to December 1932.	6,212 89	
		90,984 47
London Plant Reserve Account:—		
Additional value placed on Plant in London on July 31, 1930.		6,483 70
Saleable Books Reserve Account:—		
As per Balance Sheet, December 31, 1931.	4,630 00	
Less value of books sold	42 50	
		4,587 50
Surplus Account:—		
Balance of Income and Expenditure as per Balance Sheet, December 31, 1931.	180,634 19	
Add excess of Income over expenditure for the year 1932.	67,033 93	
Less amount transferred to Experiment Station, Development Scheme.	6,212 89	
	60,821 04	
		241,455 23

ASSETS.

	Rs. cts.	Rs. cts.
Land Acquisition Account:—		
As per Balance Sheet, December 31, 1931.		984 07
Buildings Account:—		
As per Balance Sheet, December 31, 1931.	47,734 88	
Less depreciation written off	2,386 74	
	45,348 14	
Add purchases during the year	400 00	
		45,748 14
Laboratory Apparatus Account:—		
As per Balance Sheet, December 31, 1931.	4,869 68	
Less depreciation written off	1,217 42	
	3,652 26	
Add purchases during the year	1,286 73	
		4,938 99
Water Supply:—		
As per Balance Sheet, December 31, 1931.	2,080 02	
Less depreciation written off	208 00	
		1,872 02
Furniture, Fittings and Office Equipment:—		
As per Balance Sheet, December 31, 1931.	7,329 61	
Less depreciation written off 732·96, and cost of 1 typewritter sold 300/-	1,032 96	
	6,296 65	
Add purchases during the year	762 13	
		7,058 78
Development of Experiment Station:—		
As per Balance Sheet, December 31, 1931.	84,771 58	
Add expenditure during the year	6,212 89	
		90,984 47
Stock Account of Saleable Books:—		
As per Balance Sheet, December 31, 1931.	4,630 00	
Less value of books sold	42 50	
		4,587 50
London Plant Account:—		
As per Balance Sheet, December 31, 1931.	9,316 67	
Less depreciation written off £100	1,350 00	

ESTIMATES FOR 1933.

(Adopted by the Board, November 17, 1932.)

REVENUE STATEMENT.

Income for 1933.			Rs.	cts.
1.	Cess Collections ...	...	105,350	00
2.	Rent of Bungalows ...	...	—	
3.	Interest ...	...	8,000	00
4.	Sale of Publications ...	...	300	00
5.	Sundry Receipts ...	...	100	00
	Total Rs. ...		113,750	00

EXPENDITURE STATEMENT.

		Rs. cts.	Rs. cts.
1.	**Personal Emoluments:—**		
	Salaries and Wages	44,433 00	
			44,433 00
2.	**Laboratory:—**		
	(*a*) Upkeep, Chemicals and Apparatus	2,000 00	
	(*b*) Apparatus from London ...	1.000 00	
	(*c*) Samples for Imperial Institute	500 00	
	(*d*) Dusting Experiments ...	500 00	
	(*e*) Routine tests on Chemicals ...	200 00	
			4,300 00
3.	**Buildings:—**		
	(*a*) Upkeep of Buildings ...	1,000 00	
	(*b*) Insurance ...	300 00	
	(*c*) Upkeep of Water Supply ...	450 00	
	(*d*) Upkeep of Roads ...	300 00	
	(*e*) Furniture replacements ...	300 00	
			2,350 00
4.	**Office:—**		
	(*a*) Printing and Advertising ...	1,500 00	
	(*b*) Stationery ...	1,000 00	
	(*c*) Postages ...	1,000 00	
	(*d*) Books and Periodicals ...	500 00	
	(*e*) General Charges ...	500 00	
	(*f*) Audit and Accountancy ...	300 00	
	(*g*) Telephones	480 00	
			5,280 00
5.	**Travelling:—**		
	(*a*) Travelling expenses of staff	4,000 00	
	(*b*) Travelling expenses of members of the Board of Management ...	1,000 00	
			5,000 00
6.	**Experiment Station:—**		
	Development and Upkeep ...	5,726 00	
			5,726 00

EXPENDITURE STATEMENT.—*(Contd.)*

7.	**Special Charges:—**		
	London Advisory Committee's expenditure	18,900 00	
			18,900 00
8.	**Sinking Fund:—**		
	Return passages to England ...	1,800 00	
			1,800 00
9.	**Depreciation Account:—**		
	On Buildings, Furniture, Laboratory Apparatus etc. ...	4,550 00	
			4,550 00
		Total Rs. ...	92,339 00

Summary:—

Estimated total income		113,750 00
Estimated expenditure during 1933		92,339 00
Estimated surplus at end of December, 1933		Rs. 21,411 00